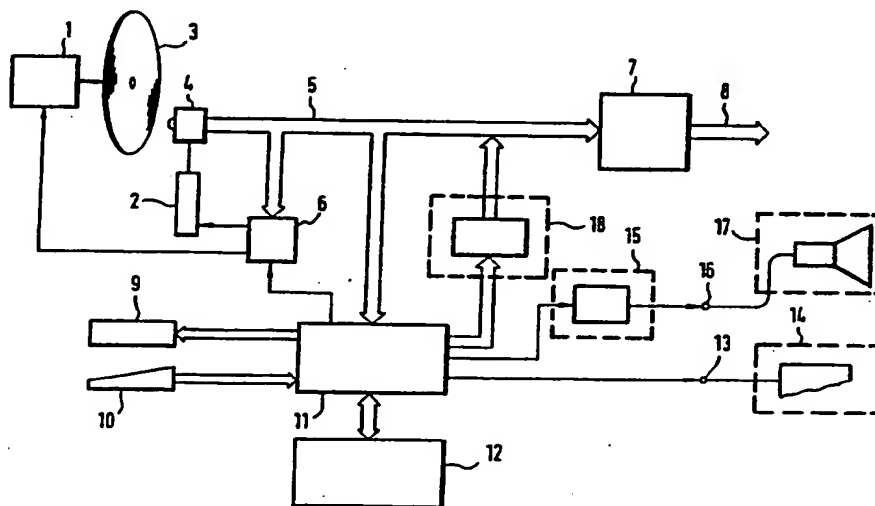




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : G11B 27/00, 27/11, 27/28 G11B 27/34	A1	(11) International Publication Number: WO 92/07360 (43) International Publication Date: 30 April 1992 (30.04.92)
(21) International Application Number: PCT/EP90/01693 (22) International Filing Date: 10 October 1990 (10.10.90) (71)(72) Applicant and Inventor: MORO, Mario [IT/US]; 3201 Pincford Drive, Middletown, PA 12057 (US). (74) Agents: LEHN, Werner et al.; Arabellastrasse 4, D-8000 Munich 81 (DE). (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), NO, SE (European patent), US.		Published <i>With international search report.</i>

(54) Title: A RECORDING MEDIUM LIBRARY MANAGEMENT SYSTEM**(57) Abstract**

A digital reproduction system in particular an audio, video or audio-video digital system includes a tracking and reading means (2, 4, 6) for reading first digital data recorded on a recording medium (3), a memory (12) for storing second digital data, an encoder (11) for encoding a part of the digital data read by the tracking and reading means (2, 4, 6) and display means (9; 14; 17; 18) for displaying the second digital data read from the memory (12). The address location in the memory (12) of the second digital data which is associated with the first digital data is determined by encoding a part of the first digital data read from the recording means. In this way, bibliographical data stored in the memory (12) can be addressed and displayed for the relevant part of pre-recorded information on the recording medium. The second digital data can be input to the memory by a keyboard (10) or be read directly from the recording medium (3) or from another recording medium (3) which serves as a general catalogue. The control of the system may be carried out by a central processing unit (11).

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A RECORDING MEDIUM LIBRARY MANAGEMENT SYSTEM

The present application relates to a device and to a method of operating the device, for storing and displaying text information relating to the content of the information stored on a digital recording medium. The invention is particularly
5 suitable for application to any pre-recorded digital recording medium which cannot be subsequently altered or amended by the user, such as compact discs, laser discs and pre-recorded digital magnetic cassettes or discs.

10 The conventional digital magnetic cassette or compact disc player is either not able to display any data relating to the content of the cassette or disc or is only able to display very limited information such as the number of different items recorded and their length of duration.

15 Such a system is known from EP-A-0 029 946. As shown in Fig. 1, information is read from a magnetic tape (100) by a head (110) and is transmitted to a memory (T) via a buffer memory (S,S'). The information which is read normally consists of
20 a playing time and a track number and a display may be provided for continuously displaying information contained in the buffer memory.

25 This system requires that the necessary information relating to a particular item which has been recorded must be previously recorded onto the magnetic tape (10). Of course it would be possible to supply pre-recorded magnetic cassettes or compact discs with pre-recorded bibliographical information relating to the recorded items but the practical
30 situation is that present users have a considerable library of pre-recorded magnetic tape cassettes and/or compact discs which may no longer be altered or augmented.

35 It may be assumed that in the future, pre-recorded magnetic tape cassettes or compact discs will be provided with more

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bibliographic data recorded on the medium itself. Such data could be the title and artist involved as well as possible historical and interesting information relating to the works recorded on the recording medium. Such information could be stored and displayed in accordance with the system shown in EP-A-0 029 946 but this system would not solve the problem of storing and displaying equivalent information for digital cassettes or discs which have been manufactured according to the older system. There is therefore a requirement for a system which is adaptable to the older system as well as to any future recording media with an increased amount of bibliographical data already pre-recorded thereon.

A further disadvantage with present systems in which only the track number and duration is displayed is that the user must first consult the cover or casing of the recording medium or consult a separate pamphlet in order to determine which title is located at a particular track position. In modern audio hi-fi systems in which the sequence of items to be played can be pre-programmed, it is therefore necessary for the user to set up the programme based on the number of the track and not upon the title of the piece to be played. In a system in which a plurality of recording media can be automatically selected from a magazine, pre-programming the sequence to be played can be a lengthy procedure.

Further, when the number of recording media becomes large it often becomes useful to have a catalogue of the various recorded items. At the present time, this has to be done on a manual basis by writing down any bibliographical information which may be considered to be useful in a catalogue or book. No simple device is available for printing out the complete list of works in the library.

A similar problem exists with juke boxes in which the titles of the pieces of music which can be played must be manually

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entered on the console of the machine. Every title which is added or replaced must also be added manually.

5 Summarizing the above, there is a need for being able to store and display more information relating to recorded items on a recording medium such as compact discs (audio), laser discs (video) or magnetic tape cassettes.

10 The object of the present invention is therefore to provide a system which is capable of storing and displaying bibliographical data relating to recorded information on a recording medium.

15 A further object of the present invention is to provide a system in which existing recording media may be used as well as recording media in which the bibliographical data is already pre-recorded.

20 A further object of the present invention is to provide a system in which the pre-recorded item may be searched not only by its sequence number on the recording medium but also by its title.

25 A further object of the present invention is to provide a system with which bibliographical data relating to the library of recording media can be printed out and updated.

30 The above objects are solved by a digital reproduction system, in particular, an audio, video or audio-video digital system including tracking reading means for reading first digital data stored on a selected track of a recording medium and for outputting said first digital data as a digital signal; memory means for storing second digital data, said memory means being non volatile memory means; encoding means
35 operatively connected to said tracking and reading means for encoding a part of the first digital data and read/write

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means for reading said second digital from a memory address location in said memory means characterized by said encoding means including means for generating a memory address signal determined from said encoded first digital data, said memory address signal determining the said memory address location.

The objects of the invention are also solved by a method of operating an audio/digital reproduction system, in particular, an audio, video or audio-video digital system, including non-volatile memory means, comprising: reading first digital data from a selected track of a recording medium; encoding said first digital data to form a memory address signal; reading second digital data stored in said memory, at a memory address location determined by said address signal.

Further, advantageous details and embodiments of the present invention are described in the following, making use of the drawings in which;

Fig. 1 shows a conventional prior art recording system,

Fig. 2 shows a schematic outline of the components of an embodiment of the present invention,

Fig. 3 shows an arrangement of the information in the non volatile memory in the recording system in accordance with one embodiment of the present invention,

Fig. 4 shows the recording system in accordance with the one embodiment of the present invention,

Fig. 5 shows an organisation of the memory addresses in the memory according to the present invention,

- 5 -

Fig. 6 is a flow chart of the procedure for learn and search mode addressing.

5 The recording medium library management system according to the present invention is described in the following, based on one embodiment of the invention relating to a compact disc player. The invention however is equally applicable to laser (video) discs, DAT magnetic tapes or magnetic discs. The embodiment also includes a programmed CPU, however the same
10 programme features may be carried out by dedicated hardware as is well known in the art.

15 In Fig. 2, the motor (1) drives the disc (3). The pick-up device (4) is controlled during tracking by a control system (6) operating on a linear motor (2) in a conventional manner. The pick-up (4) is connected to the control system (6) by way of a digital bus (5) for transfer of information. The pick-up (4) is arranged to read the data recorded on the compact disc (3) in the conventional manner. During normal
20 playing of the compact disc, the data from the pick-up (4) is transmitted to the digital analogue converter (7) and the analogue music signal is then transmitted to amplifiers/loudspeakers via the analogue bus (8).

25 The data read by the pick-up (4) is also supplied to the central processor (11) which is linked to a memory (12). The memory (12) includes a non-volatile memory for storing the bibliographical data as well as programming data. The non-volatile memory may also be constituted by a separate
30 floppy disc or hard disc unit. Data can also be input to the central processor (11) via an inputting device (10) which may be a keyboard or any similar device such as a bar code reader for reading information printed in the form of a bar code on the casing of the respective compact disc. The central
35 processor (11) can also output data to a display (9) or via an RF output (16) to a TV monitor (17) or via a serial output

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(13) to a printing device (14). For certain applications the output of the central processing unit (11) may be output to a voice synthesizer (18) whose output is connected either to the digital bus (5) or the analogue bus (8) so that the data from the central processing unit is converted into audible speech. The central processor (11) controls the operation of all these peripheral devices based on pre-programmed instructions.

10 The above described audio digital system operates in three different modes:

Search mode

15 In this mode the information about a specific disc currently being played is retrieved from the memory (12).

Learn mode

20 In this mode, information, in particular, bibliographical data is transferred to a specific memory address location in the memory (12).

Report mode

25 In this mode it is possible to display or print-out a series of reports which may consist of the listing of the discs in the owner's collection complete or sorted by category, author, performer or title, etc.

30 Search mode

During the search mode, the pick-up (4) reads N bytes of information from the disc (3). These N bytes are then processed in the central processing unit (11) which contains means for calculating in accordance with a particular algorithm. This algorithm is constructed in such a way that

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starting from the N bytes read from the disc and operating on them with a sequence of shifts and boolean operations, a data code (C) is calculated that is unique for each disc or item on each disc. The code (C) is then processed through means
5 for generating an address code according to an addressing algorithm (hash table or equivalent) to determine an address code (A) in the memory where the bibliographical information relating to the disc or to the item on a disc currently being played can be found. The N bytes of information read from
10 the disc can be specially pre-recorded information on the disc. Alternatively, the information can be N bytes read directly from the digitally recorded information on the disc, for example, the first N bytes of the recording.

15 By using the latter method, conventional discs may be used without any modification. The number of bytes read from the disc and the number of digits of the data code must be large enough to avoid the risk that identical data codes be generated from the N bytes read from two different discs.

20 Should it occur that two different discs generate the same data code, methods may be used in order to select a further data code, for instance, the "free list" method.

25 Assuming that data code C is a 10 digit code - then

$$0 \leq C \leq 9999999999$$

and assuming that the memory to store the information has
30 1000 locations the code C can be divided by 1000 and the rest of the division ($R = \text{MOD} (C/1000)$) is

$$0 \leq R \leq 999$$

35 and can be used as address A to store the information. It is possible that from two (or more) different values of C : C_i

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and C_j the same R is calculated -

Example $C_i = 3024$ $C_j = 6024$
 $R_i = 24$ $R_j = 24$

5

To resolve this problem the memory can be organized in such a way that, in addition to the information to be stored, it contains also the value C_i that generated that particular $A_i = R_i$ and the address AFL where in an additional memory area, called "free list", the record related to another C_j having $R_j = R_i$ is stored (Fig. 5).

10

Initially, when the memory is empty in the column C and AFL, at every location is written a particular code (for instance - 1), that means that the location is empty.

15

If, in the learn mode, we read a disc D_i , generating a code $C_i = 3024$, we will have $A_i = R_i = \text{MOD}(C_i/1000) = 24$. Currently in the memory $C_{24} = -1$, meaning that the location is free, so the information of D_i can be stored at location 24:

20

ADDR.	C	AFL	DATA
24	3024	- 1	D_i Data

25

When another disc D_j is read in the learn mode, generating a code $C_j = 6024$, we will have

$$A_j = R_j = \text{MOD}(C_j/1000) = 24$$

30

The CPU then finds that the location 24 has been already occupied by

ADDR.	C	AFL	DATA
24	3024	- 1	D_i Data

35

In this case the information of D_j is written in the next available address of the free list ($A = 1000$) which is stored in a register NAFL and that address is written at AFL (24);

5	ADDR.	C	AFL	DATA
	24	3024	1000	D_i Data
	1000	6024	- 1	D_i Data

10 The same procedure can be repeated if another disc D_k generates $A_k = 24$.

If, in the search mode the disc D_j is put into the player, the CPU calculates $A_j = 24$ and at location 24, finds that $C_{24} = 3024 \neq C_j$.

15 So it searches further into the free list at the location AFL (24) = 1000. There it finds $C_{1000} = 6024 C_j$ and the information related to D_j can be found.

20 The flow chart for this procedure is shown in Fig. 6. In this figure, NAFL is a register containing the next free list address available.

25 After determination of the address location in the memory (12) by the above-mentioned method, the information relating to the disc currently being played is read from the memory by read/write means and is output to the display (9), the television monitor (17), the printer (14) or the voice synthesizer (18).

30 In the memory address location in the memory (12), the relevant bibliographical data is pre-recorded.

Learn mode

35 In the event that the disc to be played has never previously been played with the system, the memory (12) may not contain the relevant information. This information is stored in the

- 10 -

memory during the learn mode.

5 In this mode, the appropriate N bytes of information are read from the disc and by using the same algorithms, methods and system elements described under the search mode, the address location in the memory (12) is determined for the particular disc. The flow chart for this procedure is shown in Fig. 6. Once the address location has been determined, the bibliographical information can be entered via the input
10 device (10) which may be a keyboard. The bibliographical information may be stored on the casing of the disc in the form of a bar code. In this case, the input device (10) is a bar code reader.

15 In the event that the disc is provided with bibliographical information pre-recorded on the disc, the input to the memory (12) may be made directly from the disc itself by further reading of data from the disc (3) using the pick-up (4) as controlled by the control system (6).
20

It is also possible to read the bibliographical information from a separate disc. In order to do this, after the above-mentioned procedure of determining the data code (C), the address code (A) and the memory address location in the
25 memory (12), the first disc is removed and a second general catalogue disc is inserted in the machine. Making use of the data code (C), the relevant portion of the general catalogue disc is located and the pick-up device (4) moved to this position on the new disc. The bibliographical information is
30 then read directly by the pick-up and control system from the second disc to the memory (12) using the memory address location determined above.

35 The general catalogue disc may contain all information relating to all discs supplied by a particular manufacturer or all discs available on the market. The general catalogue

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disc may contain information relating to the organization of the information of the memory (12) as will be described later.

Report mode

5

In the report mode the information stored in the memory (12) can be printed out via the printer (14). In order to allow the report to be sorted by title or by author, by category, by inventory location or by any other means, it is necessary
10 that the text can be retrieved not only by using the data code but also through a multiple set of pointers linking the data in different ways. The general catalogue disc may be organized in the same way. With reference to Fig. 3, a possible organization of the information in the memory (12)
15 is shown. For each set of bibliographical information, a series of pointers is specified, each pointer relating to a particular search mode. For instance, if the print-out is to occur according to author, the first pointer A1 corresponds to albeniz, the second pointer A2 would then be located at
20 the next author determined alphabetically. A similar series of pointers is arranged for the titles, performers, locations etc.

25

In this way, a series of different reports may be prepared and printed out.

Operations with the system

30

35

In order to control the function of the system according to the present invention, it is necessary to initiate various functions. In order to do so, the input means (4) can be used which can be a series of function switches. In the search and report modes, the number of switches is similar to the number provided with normal compact disc players with the
addition of function switches to selected the mode and
operate the display. In the learn mode, an additional

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keyboard is required to input the biographical information.
With reference to Fig. 4, the keyboard (4) may be located
below the normal conventional compact disc electronics and
mechanics such that the keyboard may be pulled out only when
5 learn mode operations need to be carried out.

The necessary information may also be input by means of a bar
code reader, the information being stored on the cover of the
disc as a bar code.

10

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Claims:

1. Digital reproduction system, in particular an audio, video or audio-video digital system including:

tracking and reading means (2,4,6) for reading first digital data stored on a selected track of a recording medium (3) and for outputting said first digital data as a digital signal;

memory means (12) for storing second digital data, said memory means (12) being non-volatile memory means;

encoding means (11) operatively connected to said tracking and reading means (2,4,6) for encoding a part of the first digital data, and

read/write means for reading said second digital data from a memory address location in said memory means (12), characterized by

said encoding means (11) including means for generating a memory address signal determined from said encoded first digital data, said memory address signal determining the said memory address location.

2. Digital reproduction system according to claim 1, characterized in that said read/write means (11) includes means for writing third digital data into said memory address location of said memory means (12) as said second digital data.

3. Digital reproduction system according to claim 2, characterized in that said third digital data is first digital data read by said tracking and reading means (2,4,6) from said selected track of said recording medium (3).

4. Digital reproduction system according to claim 2,

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characterized by at least one additional recording medium (3) on which general catalogue information is recorded and said third digital data is fourth digital data read by said tracking and reading means (2,4,6) from a selected track of said at least one additional recording medium (3) on which general catalogue information is recorded.

5. Digital reproduction system according to claim 2, characterized in that said read/write means (11) includes inputting means (10) for inputting said third digital data.

6. Digital reproduction system according to claim 5, characterized in that said inputting means (10) is a keyboard.

7. Digital reproduction system according to claim 5, characterized in that said inputting means (10) is a bar code reading system.

8. Digital reproduction system according to any of claims 1 to 7 characterized by a display means (9;14;17;18) for displaying alphanumeric data, said read/write means outputting said second digital data read from said memory address location to said display means (9;14;17;18).

9. Digital reproduction system according to claim 8 characterized in that said display means (9;14;17;18) is a printer (14).

10. Digital reproduction system according to claim 8 characterized in that said display means (9;14;17;18) is a visual display unit monitor (17).

11. Digital reproduction system according to claim 8 characterized in that said display means (9;14;17;18) is a voice synthesizer (18) connected to a D/A converter (7).

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12. Digital reproduction system according to any of claims 1 to 11, characterized in that encoding means (11) is a computer.

5 13. Digital reproduction system according to any of claims 1 to 10 characterized in that said non-volatile memory means is a hard disc or floppy disc memory unit.

10 14. Digital reproduction system according to any of claims 1 to 13, characterized in that said system is a compact disc player and said recoding medium is a compact disc.

15 15. Method of operating an audio/digital reproduction system in particular an audio, video or audio video digital system, including non-volatile memory means (12) comprising:

reading first digital data from a selected track of a recording medium (3);

encoding said first digital data to form a memory address signal; and

20 reading second digital data stored in said memory at a memory address location determined by said address signal.

25 16. Method according to claim 15 wherein third digital data is written into said memory means at said memory address location as said second digital data.

30 17. Method according to claim 16 wherein said third digital data is said first digital data read from said selected track of said recording medium (3).

18. Method according to claim 16 wherein said third digital data is input from an external inputting means.

19. Method according to claim 14 wherein said third digital

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data is input from a selected track of an additional recording medium (3) on which general catalogue information is recorded.

Fig.1

PRIOR ART

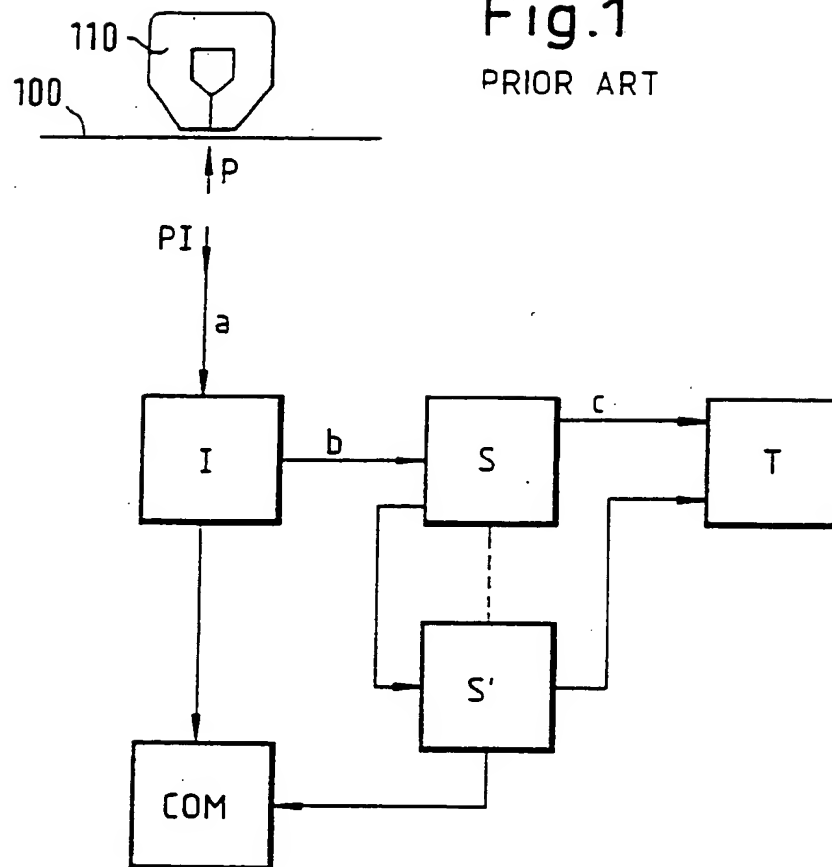


Fig.4

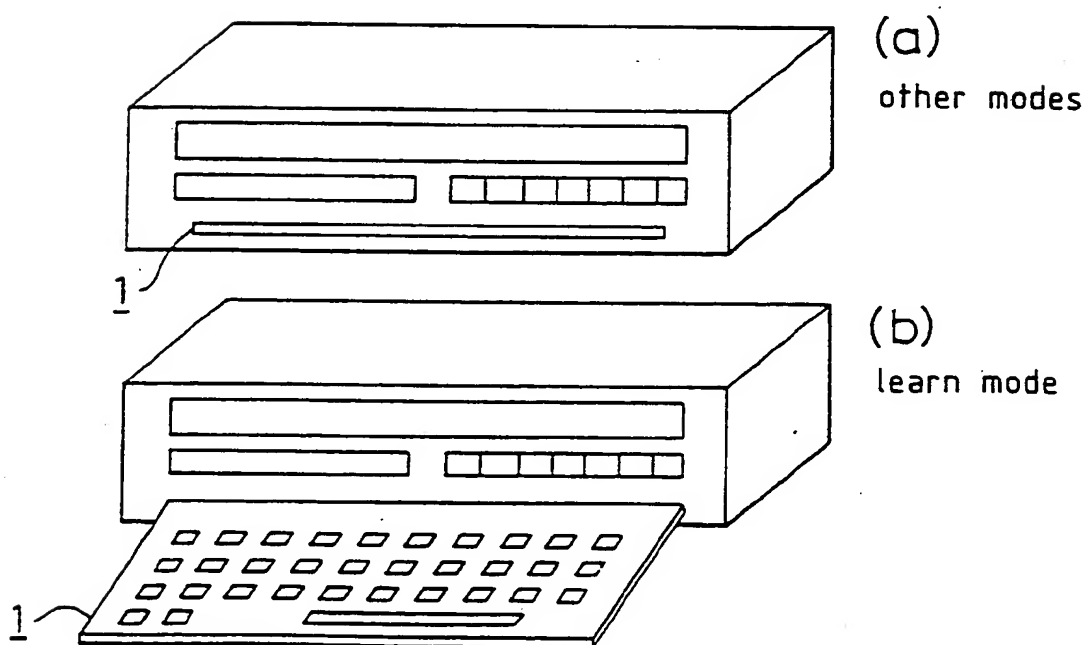


Fig. 2

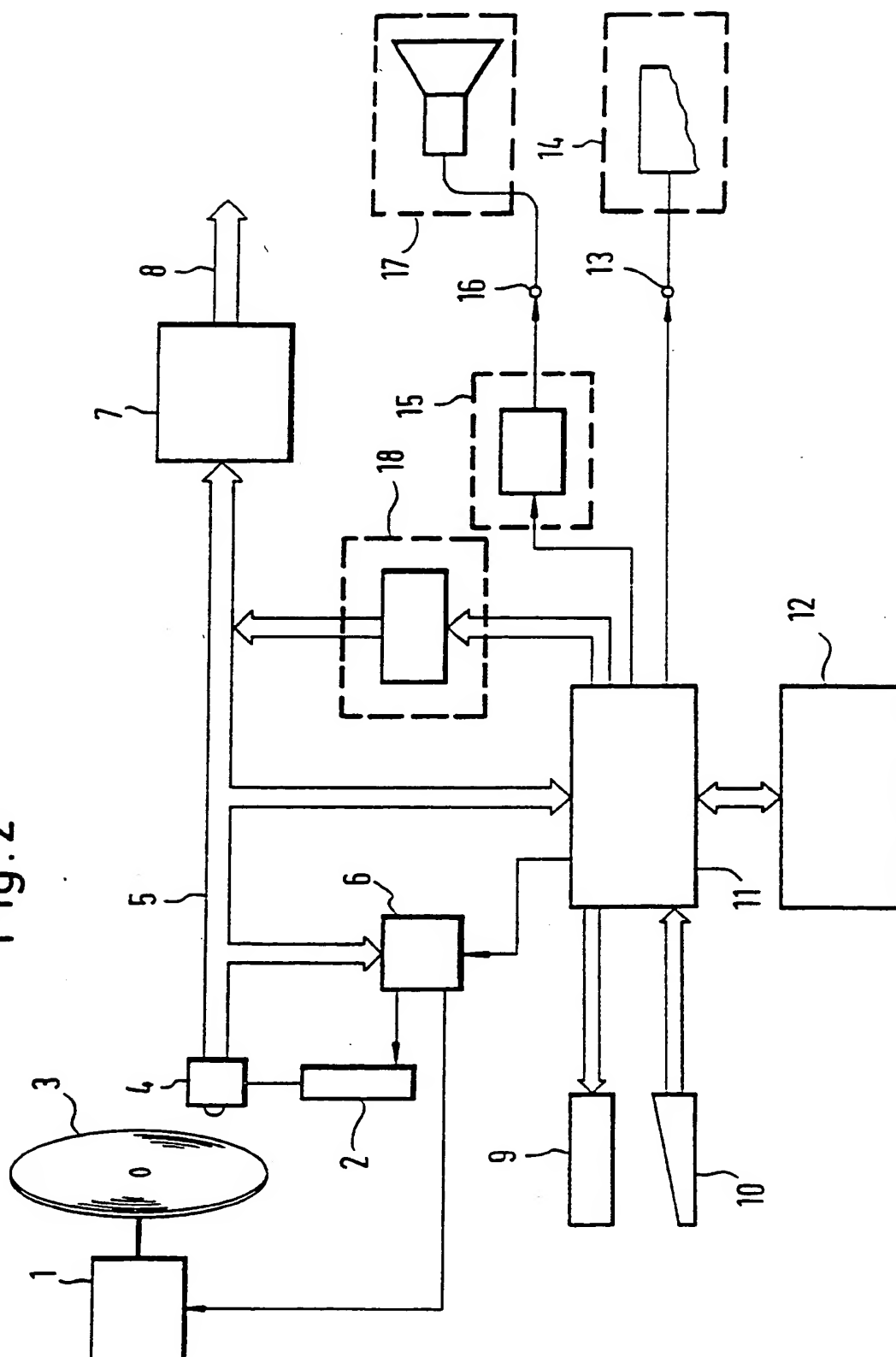


Fig.3

STARTING POINTERS

CLASSIC AUTHOR
CLASSIC TITLE
CLASSIC PERFORMER
CLASSIC LOCATION

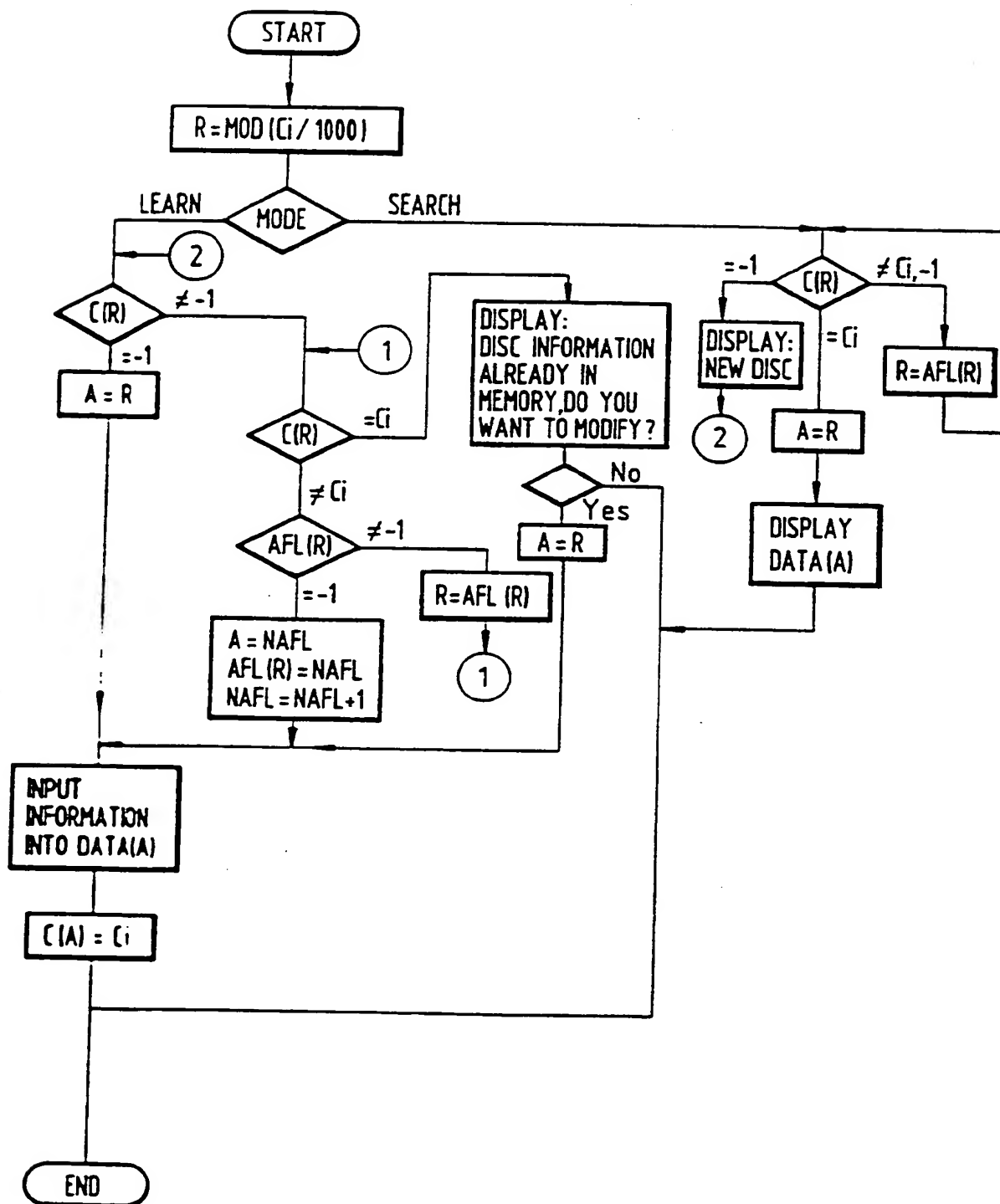
ADDR.	AUTH. POINT	TITLE POINT	PERF. POINT	LOC. POINT	AUTHOR	TITLE	PERFORMER	LOCATION	TEXT
a1	a3	a3	a _n	a2	BAC	ARIAS	SCHWARZ	A26	<input type="checkbox"/> ANDA
a2	a1	a _m	a3	a9	ALEIZ	RAPSODIA	DE LARROCHA	B13	<input type="checkbox"/>
a3	a _n	a2	a1	a1	CHOPIN	MAZURCAS	RUBINSTEIN	A11	<input type="checkbox"/> N.1

Fig. 5

FREE LIST ↓ ↑ MAIN MEMORY	ADDR.	C	AFL	DATA
	0 24 999			
	1000			

5/5

Fig.6



INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 90/01693

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC⁵: G 11 B 27/00, G 11 B 27/11, G 11 B 27/28, G 11 B 27/34

II. FIELDS SEARCHED

Minimum Documentation Searched *

Classification System :

Classification Symbols

IPC⁵

G 11 B, G 07 F

Documentation Searched other than Minimum Documentation
to the extent that such Documents are included in the Fields Searched *

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	EP, A, 0322037 (N.V. PHILIPS' GLOEILAMPEN-FABRIEKEN) 28 June 1989 see the whole document ---	1-19
Y	US, A, 3668647 (EVANGELISTI et al.) 6 June 1972 see abstract; column 2, line 26 - column 4, line 37 ---	1,12,15
Y	EP, A, 0265167 (PIONEER ELECTRONIC CORP.) 27 April 1988 see column 7, line 12 - column 17, line 45; column 21, lines 17-19; column 21, lines 46-58; column 22, lines 16-24; column 22, line 41 - column 23, line 5; column 23, lines 50-55; claims 1,3,5,7 ---	2-8,10,13,14, 16-19
A	---	1,15
	./.	

* Special categories of cited documents: ¹⁰

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

10th June 1991

Date of Mailing of this International Search Report

12. 07. 91

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

M. PEIS

M. Peis

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, " with indication, where appropriate, of the relevant passages	Relevant to Claim No.
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Y	Patent Abstracts of Japan, volume 13, no. 146 (P-854)(3494), 11 April 1989, & JP, A, 63-308776 (TOSHIBA K. K.), 16 December 1988 see the whole document	13
A	---	1,4,8,10,14, 15,19
Y	GB, A, 2199984 (BAI PUBLISHERS) 20 July 1988 see page 7, line 20 - page 10, line 24; page 15, lines 9-27	9
A	---	1,14,15
A	GB, A, 2210724 (MUSIC HIRE GROUP LTD.) 14 June 1989 see page 2, line 1 - page 4, line 15; page 5, line 34 - page 8, line 20; page 9, lines 24-29; page 10, lines 27-30	1,2,4,8,9, 13-16,19
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A	Patent Abstracts of Japan, volume 14, no. 283 (P-1063)(4226), 19 June 1990, & JP, A, 02-083880 (HITACHI LTD.), 23 March 1990 see the whole document	1,5,7,8,10,15
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A	GB, A, 2062935 (NSM APPARATEBAU GmbH) 28 May 1981 see the whole document	1-3,5,7,8,10, 15-18
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A	EP, A, 0169597 (N.V. PHILIPS' GLOEILAMPEN- FABRIEKEN) 29 January 1986 see the whole document	1,2,5,6,8,12, 14-16,18
A	---	1,12,15
A	Proceedings of SPIE, Arlington, VA, June 8-9 1983, volume 421, SPIE, (Bellingham, Washington, US), J.B. Shaffer et al.: "Data base and file management approach for large optical disk systems", pages 20-30 see figures 9, 10 -----	1,12,15

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9001693

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